GROUP ON EARTH OBSERVATIONS

Geohazard Supersites & Natural Laboratories

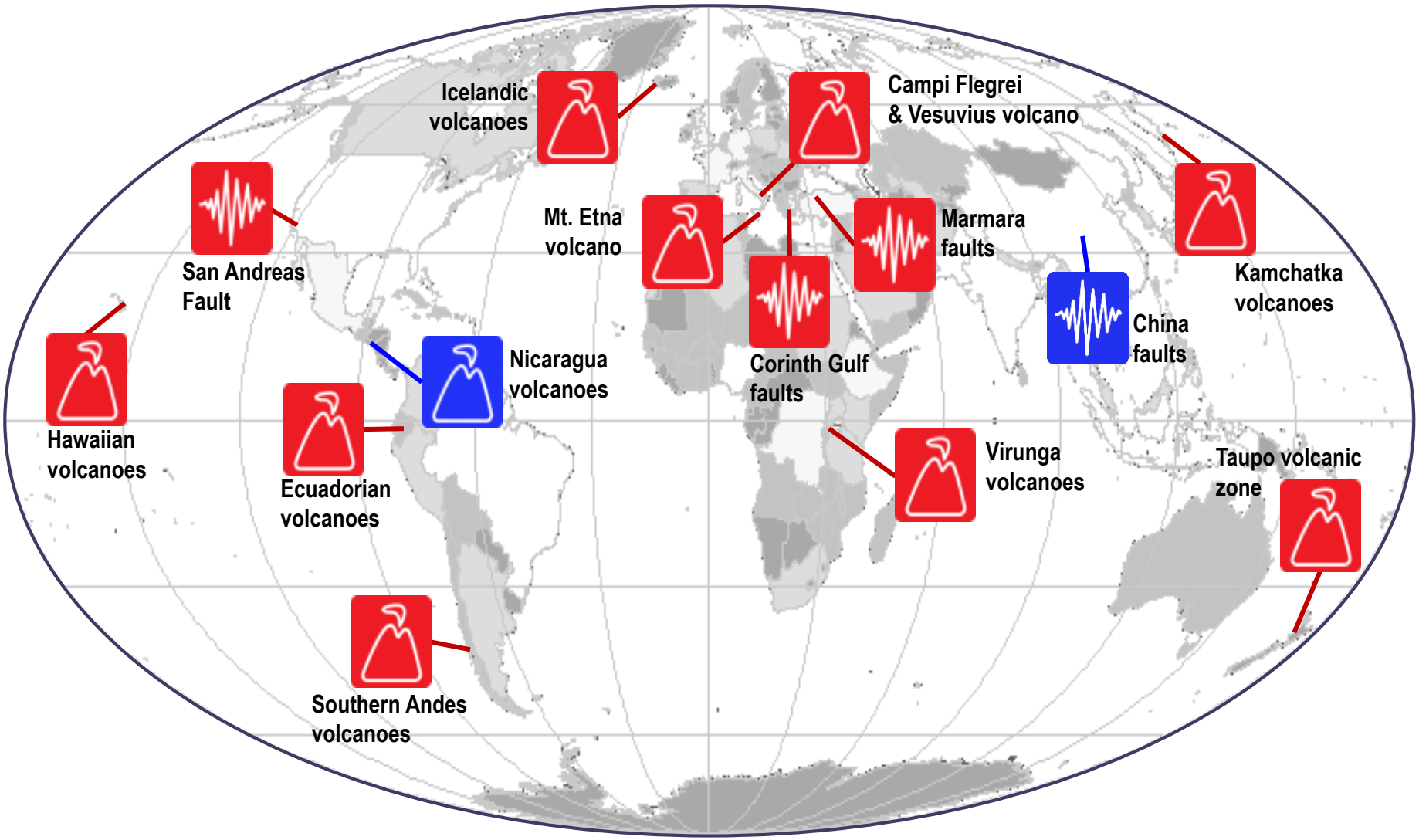
Report on the GEO-GSNL initiative

Stefano Salvi

Chair of the GSNL Scientific Advisory Committee

CEOS WG Disasters meeting #14

The Supersite network in 2020 (proposals in **blue**)



Geohazard Supersites & Natural Laboratories

	Supersite	Next Biennial report	Use of CEOS data in 2019
1	Hawaiian volcanoes	25-Oct-20(4th)	Good use of CEOS data
2	Icelandic volcanoes	5-Nov-21 (4th)	Good use of CEOS data
3	Etna volcano	9-Apr-20 (3rd)	Good use of CEOS data
4	Campi Flegrei/Vesuvius volcano	9-Apr-20 (3rd)	Good use of CEOS data
5	Marmara Fault	9-Apr-20 (3rd)	Good use of CEOS data
6	Taupo volcano	15-Apr-21 (4th)	Good use of CEOS data
7	Ecuador volcanoes	15-Apr-21 (4th)	Good use of CEOS data
8	Corinth Gulf/Ionian Islands	8-Nov-20 (2nd)	Limited use of CEOS data
9	San Andreas Fault NL	27-Apr-21 (2nd)	Limited use of CEOS data
10	Southern Andes volcanoes	14-Nov-21 (2nd)	Limited use of CEOS data
11	Virunga volcanoes	14-Nov-21 (2nd)	Good use of CEOS data
12	Kamchatka_Kuriles volcanoes	4-June-2022 (1st)	Ordering has started for Pléiades

Impact of the COVID-19 pandemia on GSNL

- No impact on initiative management and EO data acquisition
- Variable impact on ground data acquisition (some countries more than others), with most of the monitoring networks operational, although with reduced maintenance
- Large impact on field activities and scientific data acquisition, which have been strongly reduced or totally halted for a few months
- The relative value of EO data for volcano/fault monitoring has increased
- Situation has recently improved, but only in some countries

Supersite proposals

- The China earthquake Supersite
  (Revised proposal, decision to take)

- The Nicaragua volcano Supersite
  (New proposal)

China Supersite proposal **revised requests**

Objectives	Coordinator	Data requested
Monitoring and hazard assessment of China faults. Focuses on the Longmenshan and Hayuan faults, plus new earthquake ruptures in **the CSES site**.	Prof. Yun Shao, Aerospace Information Research Institute Chinese Academy of Sciences	CSK (200/year), **PRISMA Pléiades (max 10/year)** Sentinel 1 at 6-day repeat pass

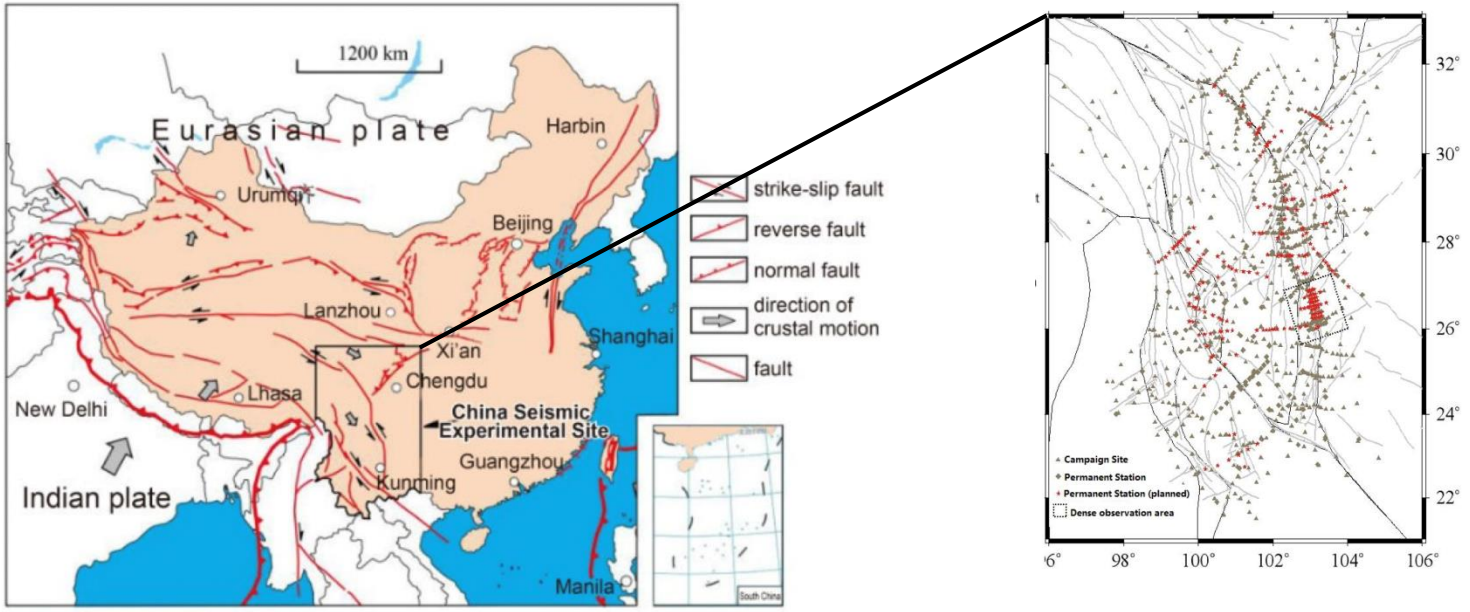
ESA has agreed to implement a temporary 6-day acquisition plan over orbit 62 in the area, until December 2020. During this period ESA will evaluate the possible impacts of this plan over other areas, and the proposers will demonstrate that the 6-day repeat pass is actually producing better results wrt the standard pass.

China Supersite proposal

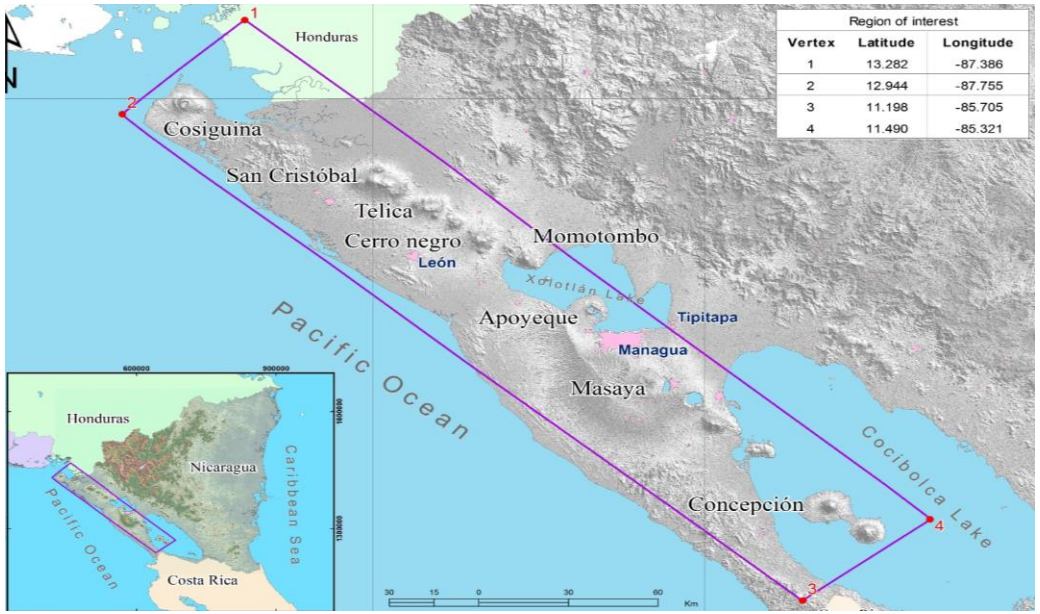
The rule of at least two agencies supporting a Supersite seems to be respected for the China proposal (ASI, ESA, CNES ?)

ASI could not support Objective 1 (earthquake mapping over all of China). We propose to limit CSK data for Obj. 1 to the CSES area, on a best effort basis.

We should decide and provide a final response to the proposing team.



Nicaragua Supersite proposal



Title: *Volcano-tectonic Geohazard Interaction within the Nicaraguan Depression*

Coodinator:

Iris Valeria Cruz Martínez
Director General of Geology and Geophysics, Nicaraguan Institute of Territorial Studies – INETER

International partners:

Pensilvania University
Observatoire du Physique du Globe
Universität Heidelberg
Universidad Nacional Autónoma de México

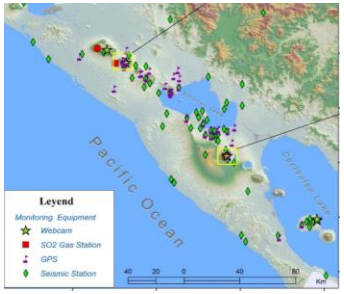
Nicaragua Supersite proposal objectives

- to access satellite EO data to complement the ground networks;
- to learn how to use them for volcano monitoring and surveillance;
- to improve knowledge of key geological processes and assess volcanic hazard;
- to establish wider international scientific collaboration;
- to progress on ground data sharing on a global scale.

Nicaragua Supersite proposal

Strong points:

- INETER is the institution responsible for volcanic surveillance in Nicaragua and is part of the National Disaster Prevention framework (Sistema Nacional para la Prevención, Mitigación y Atención de Desastres). It provides monitoring and scientific information to government agencies and to the public;
- the Supersite is coordinated by a top level scientist;
- there is a fair amount of in situ infrastructures available.



Weak points:

- In situ data sharing could be improved (access through a formal letter to INETER Director)
- It is not clear if there are local capacities for EO data analysis and interpretation

Nicaragua Supersite EO data requests

EO data	Usage
CSK (450/year) + archive (ca. 1000)	NRT ground deformation monitoring. Background acquisitions every 2 weeks over the six volcanoes, + increment during unrest. Some spotlight images may be also requested during emergencies.
TSX (150/year)	TerraSAR X (TanDEM X) is primarily for DEM production at selected sites and scientific investigations
ALOS 2 (150/year)	NRT monitoring with InSAR; fundamental for areas with vegetation
Rsat 2 (150/year)	For monitoring during rest periods. Will complement Sentinel 1 with images with different sight lines, useful for determining 3D deformations
Pléiades (35/year)	DEM and geomorphological mapping during eruptions
Sentinel 1 at 6-day repeat pass	Ground deformation mapping

Nicaragua Supersite in situ data access

In situ data	Access
Seismic waveforms (32 seismic stations)	Open access to GSNL scientists upon request and authorization from INETER's Senior Directorate.
GPS-GNSS (14 stations)	Open access to GSNL scientists upon request and authorization from INETER's Senior Directorate.
Fixed DOAS (5 stations)	Open access to GSNL scientists upon request and authorization from INETER's Senior Directorate.
Multigas (1 station)	Open access to GSNL scientists upon request and authorization from INETER's Senior Directorate.
13 webcams	Open access to GSNL scientists upon request and authorization from INETER's Senior Directorate.

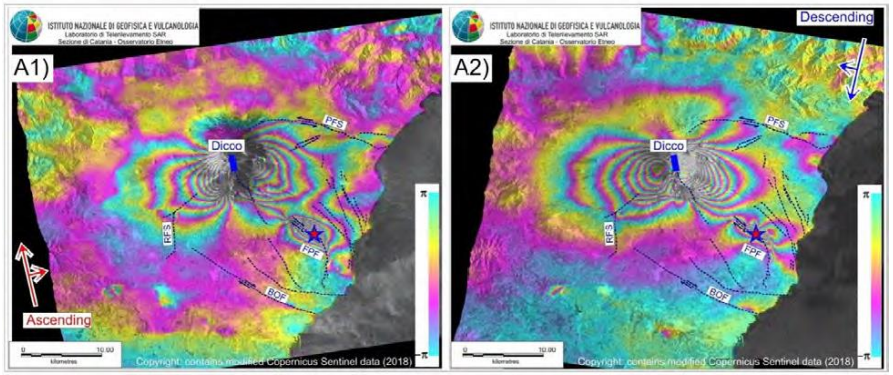
Some updates from the Supersites

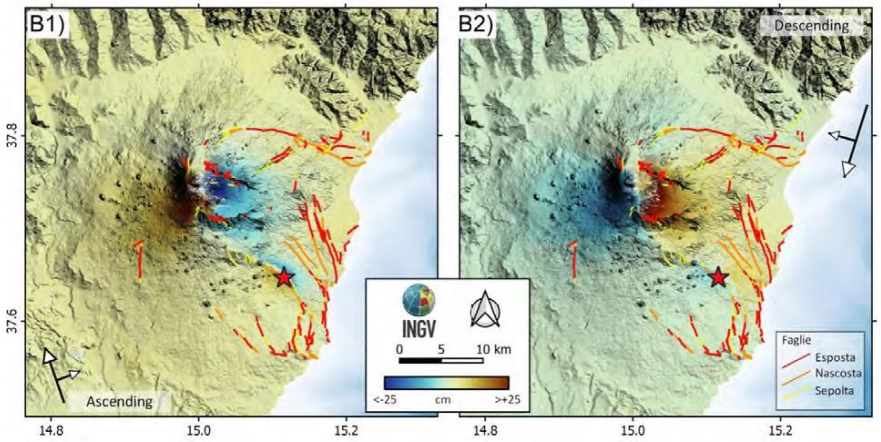
- Etna
- Campi Flegrei
- Marmara
- Ecuador
- Virunga
- Taupo
- Enceladus
- Iceland

Etna Supersite, Italy

Third biennial report just delivered.

Most used data are Sentinel 1, Sentinel 2/MSI, MSG/SEVIRI.





The December 2018 eruption

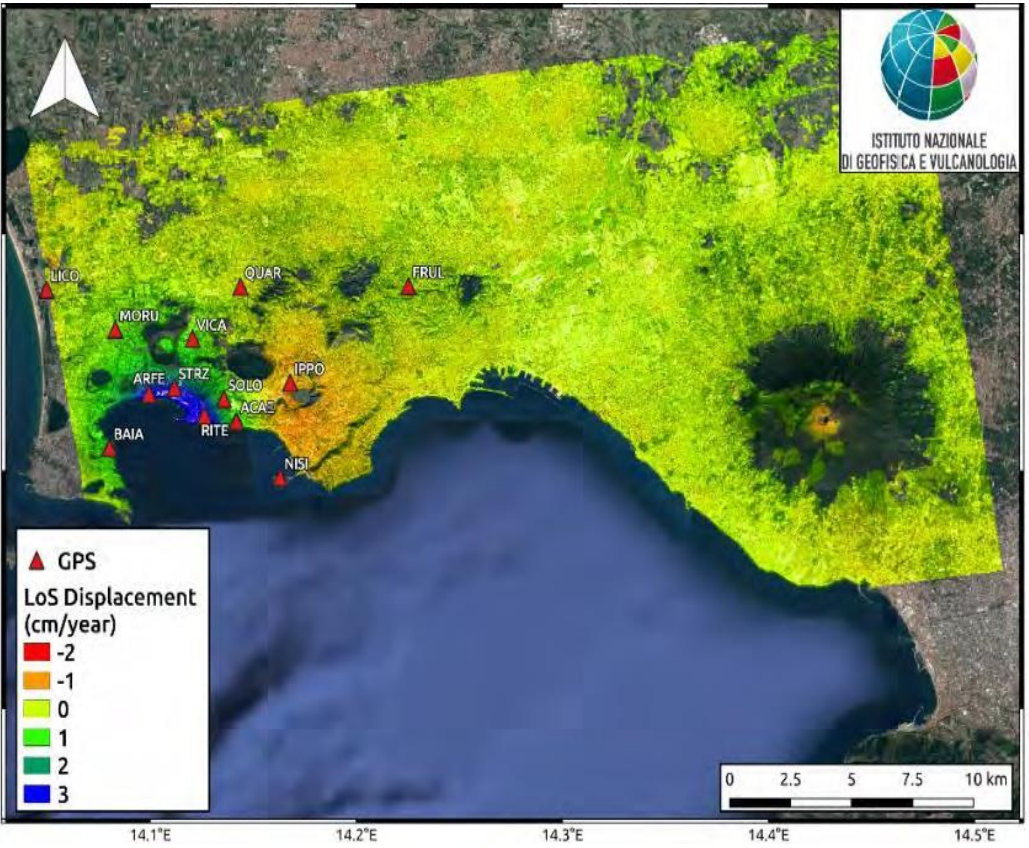
A small eruption which lasted only 3 days. It triggered strong ground deformation and a high energy seismic swarm, reactivating several shallow faults known on the volcano.

S1 data

Campi Flegrei – Vesuvius Supersite, Italy

Third biennial report just delivered.

Most used data are CSK, TSX, Sentinel 1, ASTER, Landsat 8.



CSK ground deformation 2011-2019

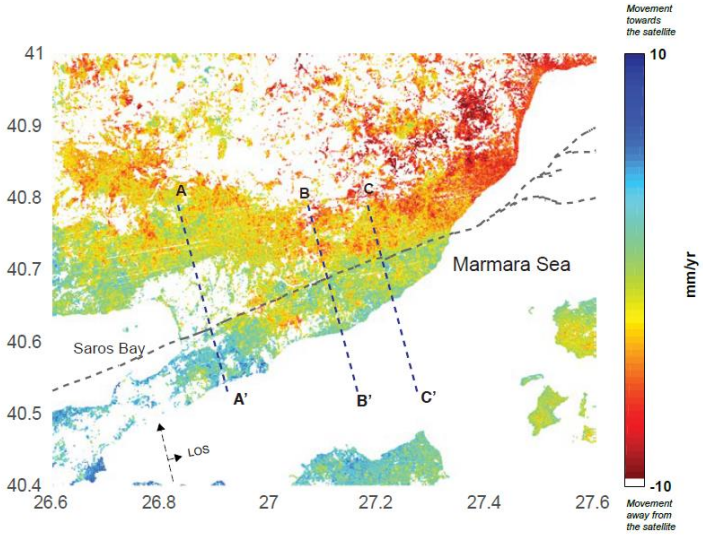
Over 3200 interferograms were used to map the ground displacement time series and mean velocity over the Supersite area.

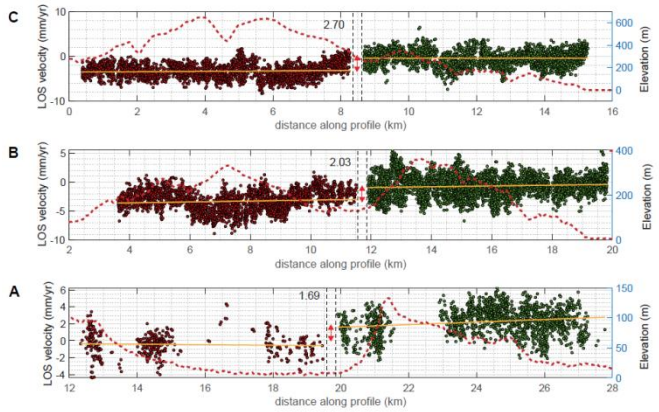
Steady uplift up to 3 cm/yr continues over the Campi Flegrei caldera.

Marmara Supersite, Turkey

Third biennial report just delivered.

Most used data are Sentinel 1, ALOS 2 (obtained directly from JAXA).





Ground deformation over an active fault

Slow creep (< 3 mm/yr) has been estimated using Sentinel 1 along the Ganos Fault, in the westernmost part of the North Anatolian fault system.

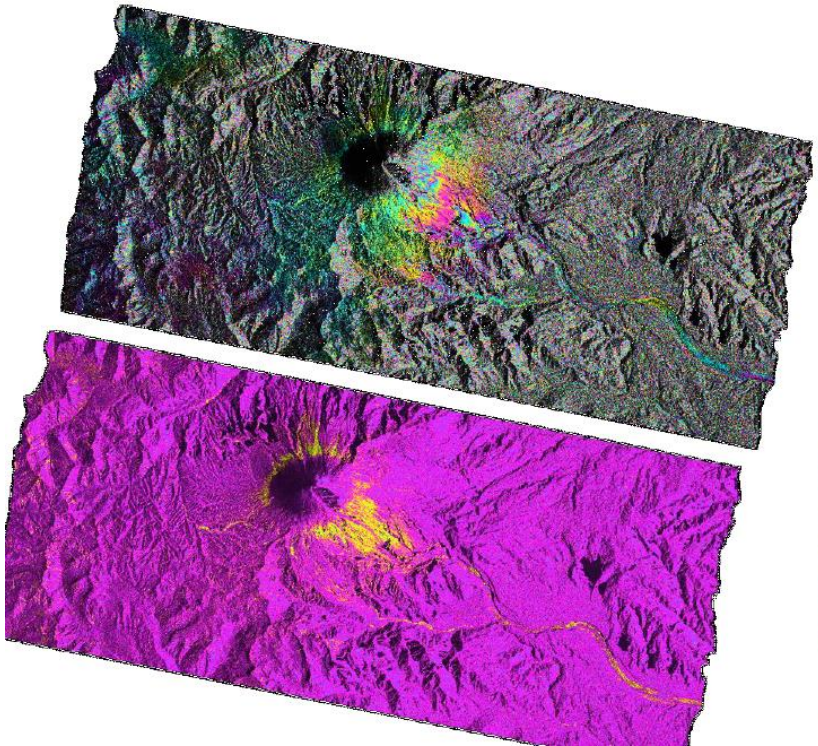
Ecuador Supersite

Most used data are Sentinel 1, TSX, CSK.

IGEPN has now developed the capacity to process a variety of InSAR data using three different softwares.

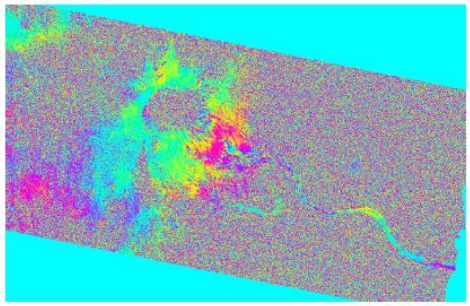
EO data invaluable for the monitoring of volcanoes, given the lockdown.

Sangay is under unrest and TSX data are extremely useful for its monitoring.



SANGAY
Interferogramas, Terrasar X

Between 19 and 30 July, 2020
173 radians (inflation, yellow)



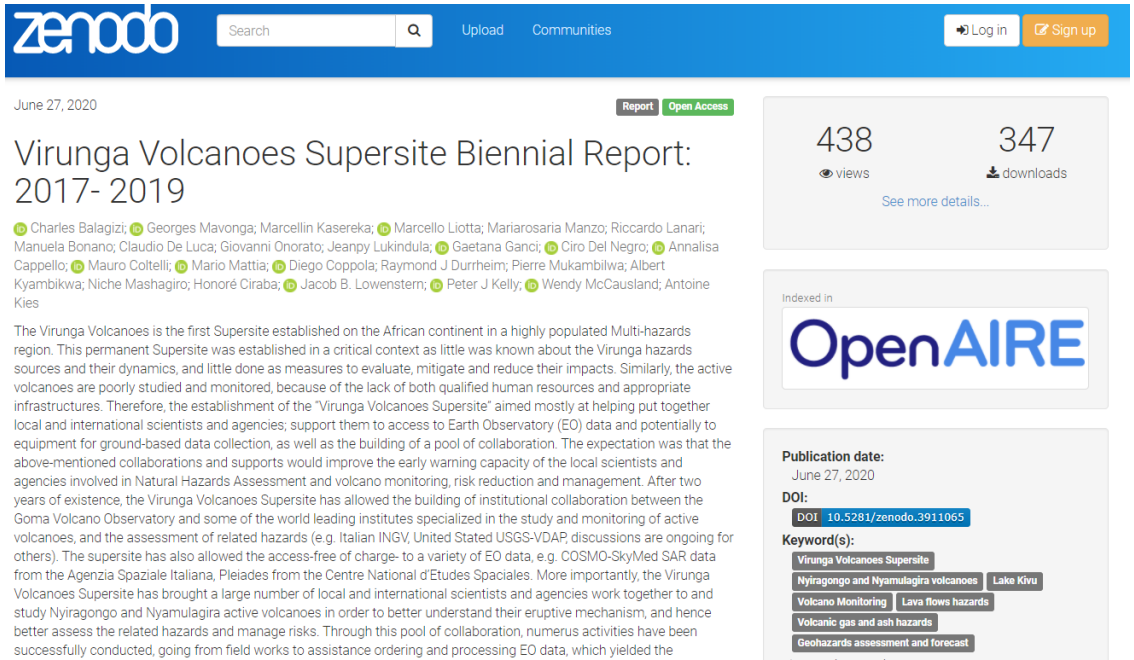
Virunga Supersite, D.R. of Congo

Most used data are CSK and Pléiades.

The Supersite has raised interest in the region, and a local meeting was being organized to coordinate further participation.

Coordinator placed a DOI on the biennial report, which is a good dissemination option.

Local capacities are still not adequate, GEO Secretariat is supporting in seeking funds for a development project for the Volcano Observatory.



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June 27, 2020 Report Open Access

Virunga Volcanoes Supersite Biennial Report: 2017- 2019

Charles Balagizi; Georges Mavonga; Marcellin Kasereka; Marcello Liotta; Mariarosaria Manzo; Riccardo Lanari; Manuela Bonano; Claudio De Luca; Giovanni Onorato; Jeanpy Lukindula; Gaetana Ganci; Ciro Del Negro; Annalisa Cappello; Mauro Coltelli; Mario Mattia; Diego Coppola; Raymond J Durrheim; Pierre Mukambilwa; Albert Kyambikwa; Niche Mashagiro; Honoré Ciraba; Jacob B. Lowenstern; Peter J Kelly; Wendy McCausland; Antoine Kies

The Virunga Volcanoes is the first Supersite established on the African continent in a highly populated Multi-hazards region. This permanent Supersite was established in a critical context as little was known about the Virunga hazards sources and their dynamics, and little done as measures to evaluate, mitigate and reduce their impacts. Similarly, the active volcanoes are poorly studied and monitored, because of the lack of both qualified human resources and appropriate infrastructures. Therefore, the establishment of the "Virunga Volcanoes Supersite" aimed mostly at helping put together local and international scientists and agencies; support them to access to Earth Observatory (EO) data and potentially to equipment for ground-based data collection, as well as the building of a pool of collaboration. The expectation was that the above-mentioned collaborations and supports would improve the early warning capacity of the local scientists and agencies involved in Natural Hazards Assessment and volcano monitoring, risk reduction and management. After two years of existence, the Virunga Volcanoes Supersite has allowed the building of institutional collaboration between the Goma Volcano Observatory and some of the world leading institutes specialized in the study and monitoring of active volcanoes, and the assessment of related hazards (e.g. Italian INGV, United Stated USGS-VDAP, discussions are ongoing for others). The supersite has also allowed the access-free of charge- to a variety of EO data, e.g. COSMO-SkyMed SAR data from the Agenzia Spaziale Italiana, Pleiades from the Centre National d'Etudes Spaciales. More importantly, the Virunga Volcanoes Supersite has brought a large number of local and international scientists and agencies work together to and study Nyiragongo and Nyamulagira active volcanoes in order to better understand their eruptive mechanism, and hence better assess the related hazards and manage risks. Through this pool of collaboration, numerus activities have been successfully conducted, going from field works to assistance ordering and processing EO data, which yielded the

438 views 347 downloads

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Indexed in OpenAIRE

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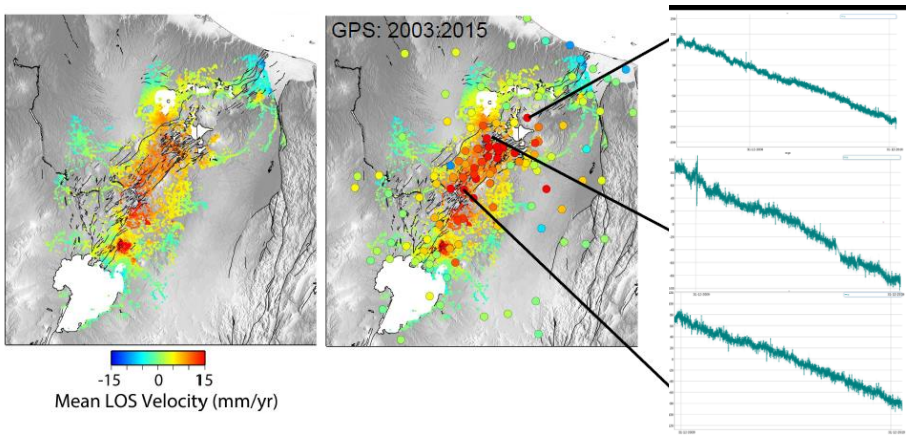
Nyiragongo and Nyamulagira volcanoes
Lake Kivu
Volcano Monitoring
Lava flows hazards
Volcanic gas and ash hazards
Geohazards assessment and forecast

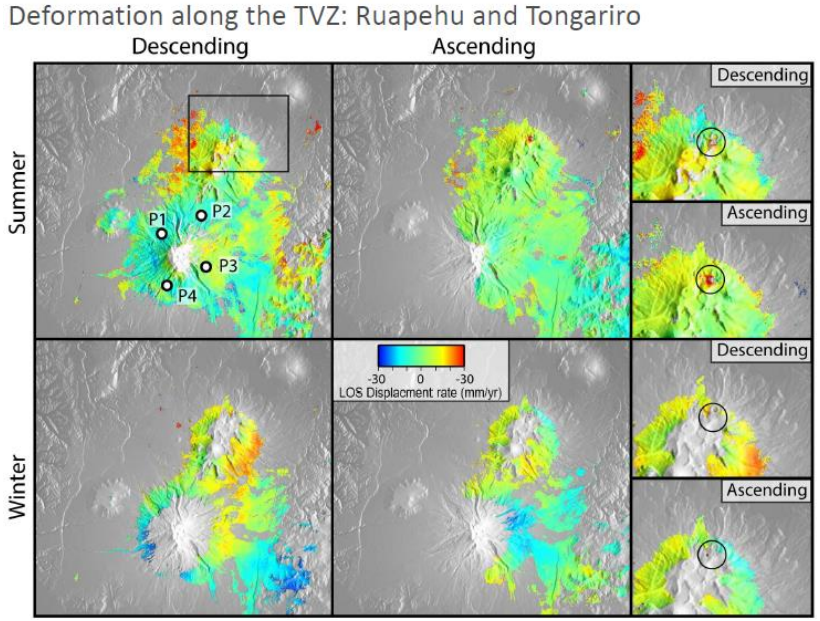
Taupo Supersite, New Zealand

Most used data are CSK, TSX and Sentinel 1.

Major volcanoes are in a period of quiescence with deformation limited to 2012 eruption site.

Deformation at White Island is dominated by shallow hydrothermal activity within crater floor and creep of SW crater wall. High res. SAR data fundamental for monitoring the main crater as access restrictions continue.





Enceladus Supersite, Greece

Little progress due to lockdown, which affected also the ground networks maintenance.

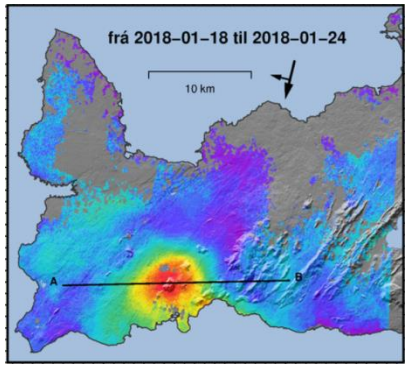
A WebGis of the Supersite in situ data has been created and is being populated : http://apollo.geosystems-hellas.gr/greeksupersite/

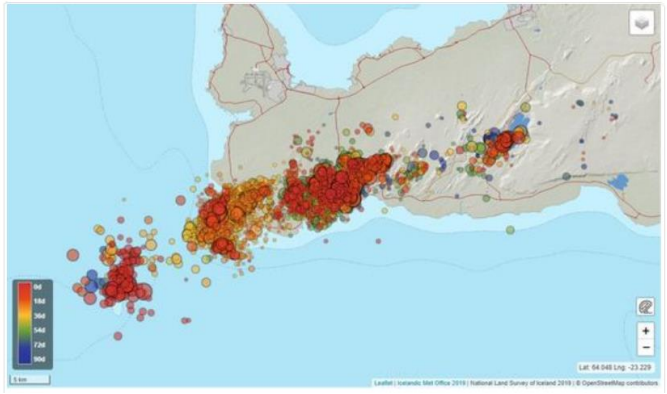
Three project proposals linked to the Supersite have been presented to local and international agencies.

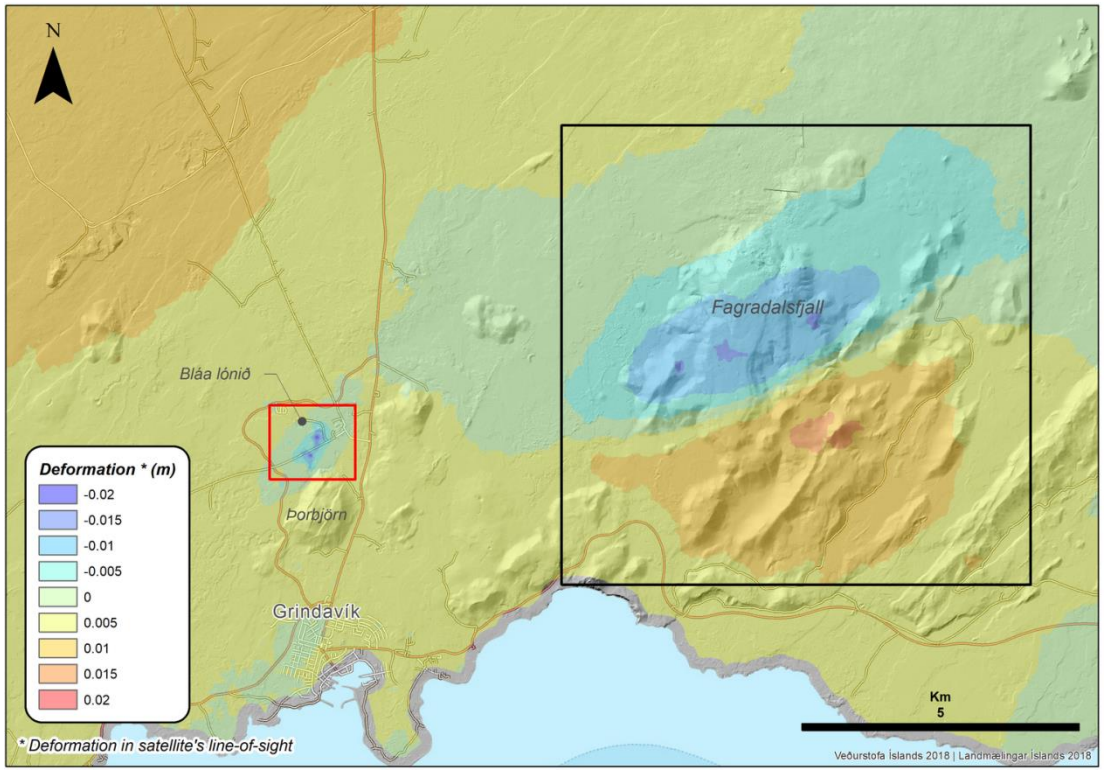
Iceland Supersite

Volcanic unrest has been ongoing in the last year at the Reykjanes Peninsula, near Reykjavik.

Various inflation episodes, as well as a fault rupture, have been mapped using TSX and S1 data, which are very important for the constant monitoring.







On TSX data ordering/delivering

Mike Poland circulated among Supersite coordinators a simple guide on TSX data ordering, which helps to place a collective image order while still receiving each new image a few days after the acquisition, without the need to wait for the entire set to be acquired.

Decisions for GSNL at WGD meeting #14

1. Decision on acceptance of China Supersite